MOUNTAIN PINE BEETLE

IMPACT SURVEY IN YELLOWSTONE NATIONAL PARK

1970

Prepared by : Douglas L. Parker

Douglas L. Parker
Entomologist, Section of Detection and Evaluation

Recommended by: M. C. GALBRAITH

Marlin C. Galbraith
Assistant Regional Forester, Div. of Timber Management

Approved by : G. L. Watts

for Vern Hamre, Regional Forester

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The following is a record of the depletion of lodgepole pine stands caused by the mountain pine beetle over the past five years in the southwestern corner of Yellowstone National Park. This report was compiled from data collected during our annual mountain pine beetle impact survey, from aerial survey records, and from information collected on the neighboring Targhee National Forest.

Briefly, the outbreak in the Park is part of a general infestation that started on the Targhee National Forest in the early 1960's. Tree mortality became evident in the Park in 1966; since that time the intensity and extent of mortality has increased (Fig. 1). 1/

The survey, which we have conducted for the past three years, has been restricted to a one-square mile area (2 miles by $\frac{1}{2}$ mile) in the extreme southwest corner of the Park (Fig. 1). Eighty-five permanent plots were established in 1968 in a grid pattern at ten-chain intervals on five lines (17 plots per line) within the survey area. In the fall of 1968, green stand data were collected on every other plot on three of the five lines, 27 plots in all. Tree mortality was recorded on all 85 plots each year. However, three years of attacks were recorded in 1968: 1968 current attacks, 1967 mortality (faders), and all other mountain pine beetle killed trees were categorized as 1966 mortality. In subsequent surveys, it was possible to detect and amend mistakes made the previous year. Trees were recorded in 2-inch diameter classes as follows: 5.0 - 6.9 inches d.b.h. (diameter at breast height) = 6-inch class, 7.0 - 8.9 inches d.b.h. = 8-inch class, etc. The variable plot method of cruising was used with a basal area factor (BAF) of 10 used on green stand plots and a 5 BAF on mortality plots.

In 1965, before the infestation reached the Park, there were 212.3 live lodgepole pine trees per acre. Subsequent depletion of the stand caused the green stand to decrease as follows: 208.6 in 1966, 203.3 in 1967, 189.4 in 1968, 161.9 in 1969, and 158.9 in 1970. These losses may seem high, but 74.8 percent of the stand above 5 inches d.b.h. is still green. If trees below 5 inches d.b.h. were included, the percentage of green trees would be higher.

1/ See the 1969 Yellowstone National Park biological evaluation for a more detailed historical account of the infestation.

A breakdown of the green stand structure above 5 inches d.b.h. follows:

Year	GREEN STEMS/ACRE d.b.h. 6	8	10	12	14	16	>16	Total
1965 (Original Green Stand)	79.7	63.0	39.8	17.4	8.2	2.0	2.2	212.3
1966	79.4	62.1	39.0	16.8	7.7	1.7	1.9	208.6
1967	79.4	61.2	37.9	15.4	6.4	1.4	1.6	203.3
1968	79.4	58.3	34.0	12.2	3.9	0.8	0.8	189.4
1969	77.6	50.3	23.3	7.7	1.8	0.5	0.7	161.9
1970	77.6	49.8	22.2	7.1	1.4	0.3	0.5	158.9

Since the beginning of the infestation, 53.4 trees per acre have been lost in the survey area due to the mountain pine beetle. 2/ Mountain pine beetle caused mortality increased steadily from 1966 to 1969, but decreased significantly in 1970. The peak of the infestation was in 1969 when 27.5 trees per acre were killed (Fig. 3). An analysis of tree mortality by 2-inch diameter classes shows that a greater percentage of large diameter trees have been lost. However, trees above 12 inches in diameter comprised a relatively small proportion of the original green stand (14 percent

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2/ In addition to insect losses, stands in and near the survey area were further damaged this spring during a severe windstorm.

of the trees above 5-inches d.b.h.). Trees 5.0 to 11.9 inches d.b.h. comprised a larger percentage of the green stand; and, even though a greater number of trees in these diameter ranges were killed, the percentage of mortality was less (Figs. 2 & 4). Again, mortality of trees below 5.0 inches in diameter was not measured, but it should be emphasized that the mountain pine beetle rarely attacks trees in the smaller diameter classes. A resumé of mortality by 2-inch diameter classes follows:

Year	DEAD STEMS/ACRE* d.b.h. 6	8	10	12	14	16	>16	TOTAL
1966	0.3	0.9	0.8	0.6	0.5	0.3	0.3	3.7
1967	--	0.9	1.1	1.4	1.3	0.3	0.3	5.3
1968	--	2.9	3.9	3.2	2.5	0.6	0.8	13.9
1969	1.8	8.0	10.7	4.5	2.1	0.3	0.1	27.5
1970	--	0.5	1.1	0.6	0.4	0.2	0.2	3.0
TOTAL	2.1	13.2	17.6	10.3	6.8	1.7	1.7	53.4

*Some mortality counts have changed slightly from year to year. Corrections in mortality predictions and sampling errors account for these changes.

A statistical analysis of the number of trees per plot for green stand data and mortality counts follows:

Stand Condition Measured	Mean Per Plot*	Standard Deviation	Standard Error	Coefficient of Variation (%)
Green Stand	7.0	5.03	0.967	72.19
1966 Mortality	0.6	1.21	0.131	218.85
1967 Mortality	0.9	1.61	0.175	187.71
1968 Mortality	2.0	2.42	0.263	118.44
1969 Mortality	3.0	3.30	0.357	110.21
1970 Mortality	0.4	1.00	0.108	222.36

*Numbers have been averaged.

The statistical measures summarized in the above table show that there is a great amount of variability in some of the survey data. It should be understood that although these survey data are highly variable, they are the best available at this time. The main reason for providing these statistical measures is to provide the reader with a relative idea of how much reliability he can place on the individual results. In general, reliability increases with an increase in the mean.

The beetle population from within the survey area and from surrounding areas will cause continued mortality in 1971. High intensity infestations are continuing to the north and east of the survey area in the Park and to the south and west on the Targhee National Forest. However, the intensity of attacks within the survey area should not surpass the 1970 infestation level, because most of the susceptible trees in the larger diameter classes have been killed. Most of the mortality should be limited to trees in the 8- to 12-inch diameter classes.

DOUGLAS L. PARKER
Entomologist

APPENDIX

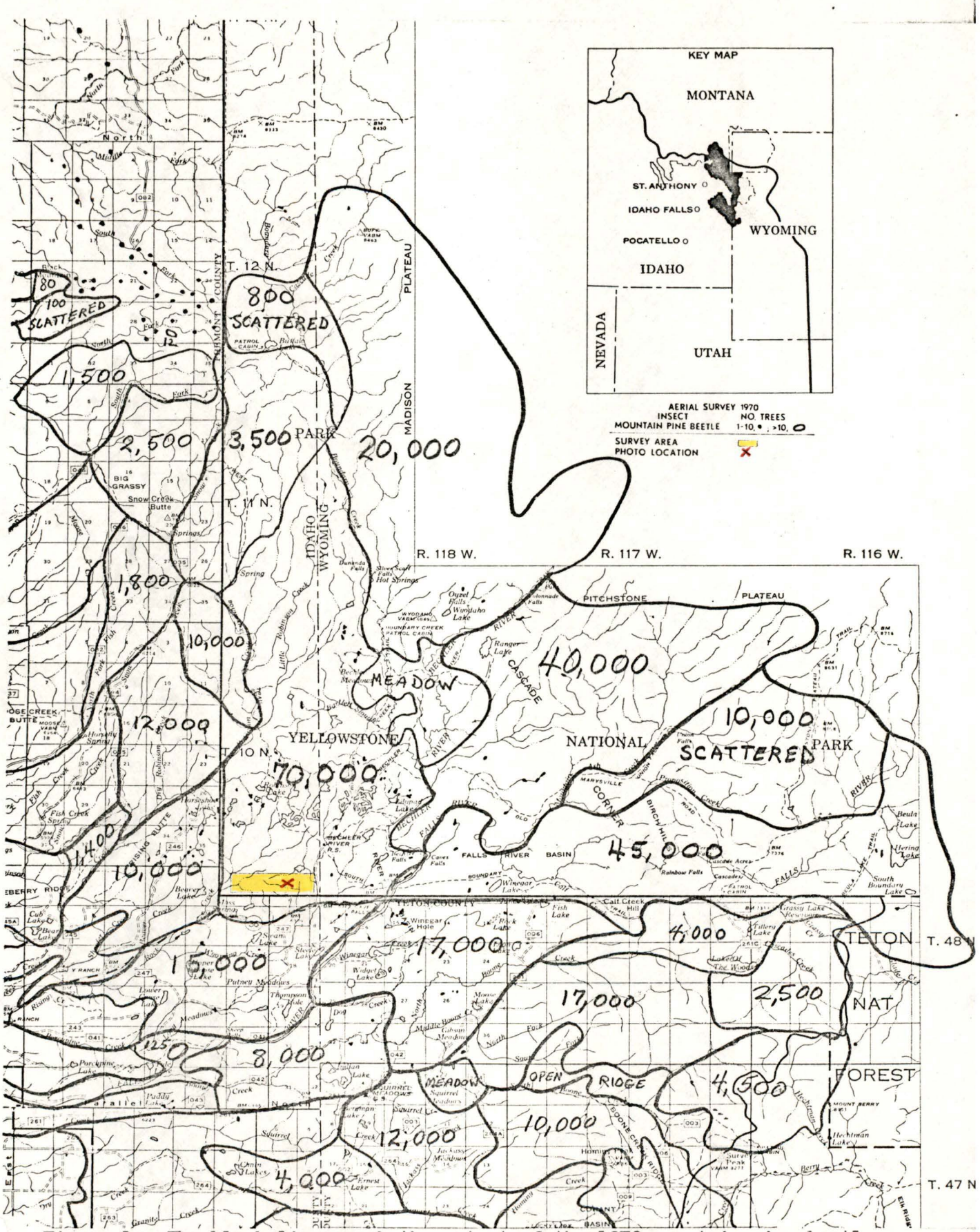

Figure 1. The black lines mark the extent of the 1970 mountain pine beetle infestation in Yellowstone National Park and on part of the Targhee National Forest. Refer to the legend for further information.

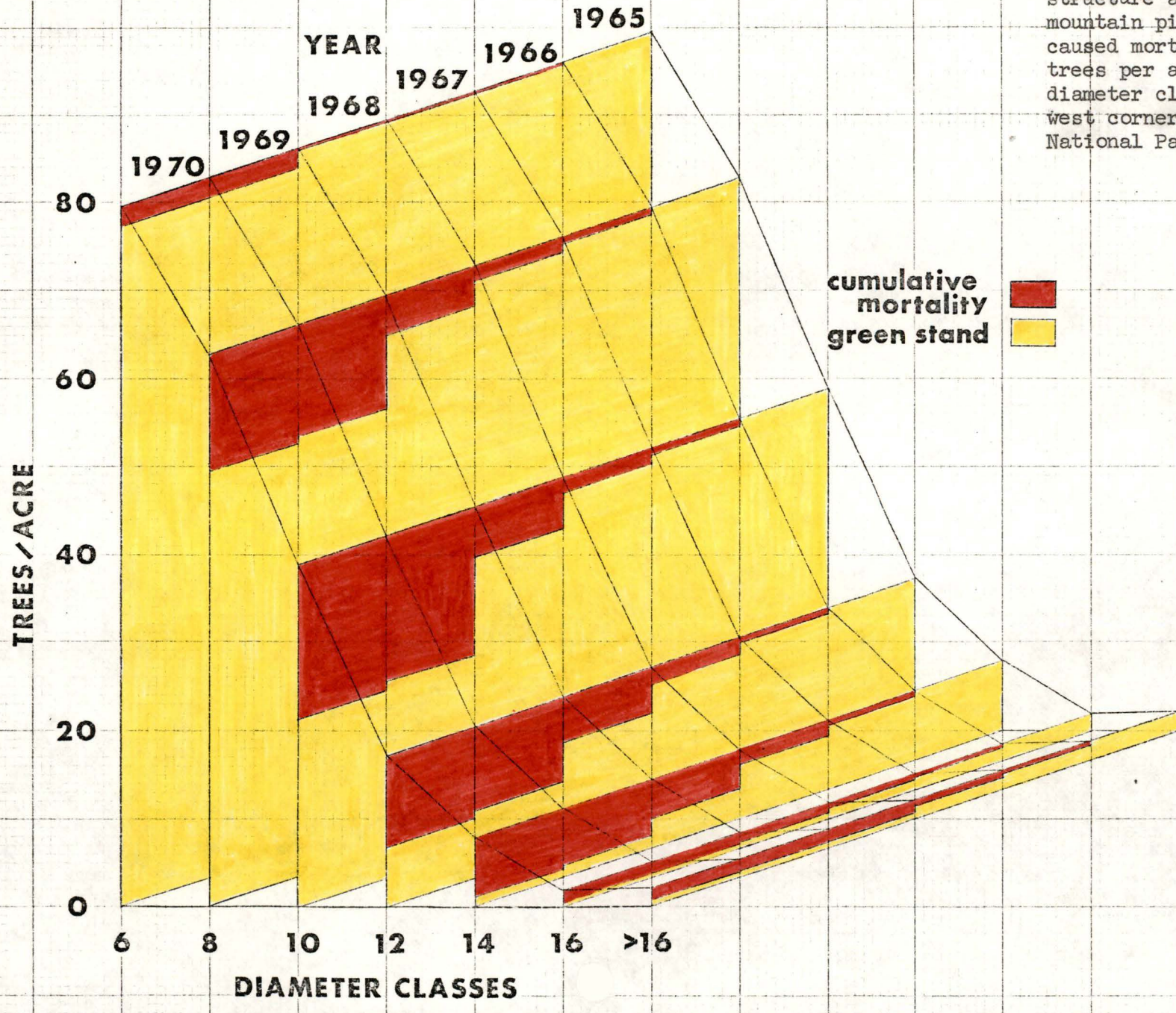

Figure 2. Three-dimensional graph shows green stand structure and cumulative mountain pine beetle caused mortality by year, trees per acre, and diameter classes (southwest corner of Yellowstone National Park).

Figure 3. The lower two-thirds of the photograph shows a portion of the survey area in the southwest corner of Yellowstone National Park in 1970. The 1969 survey revealed that there were 27.5 attacks per acre. Refer to the map (Fig. 1) for the location of the photograph.

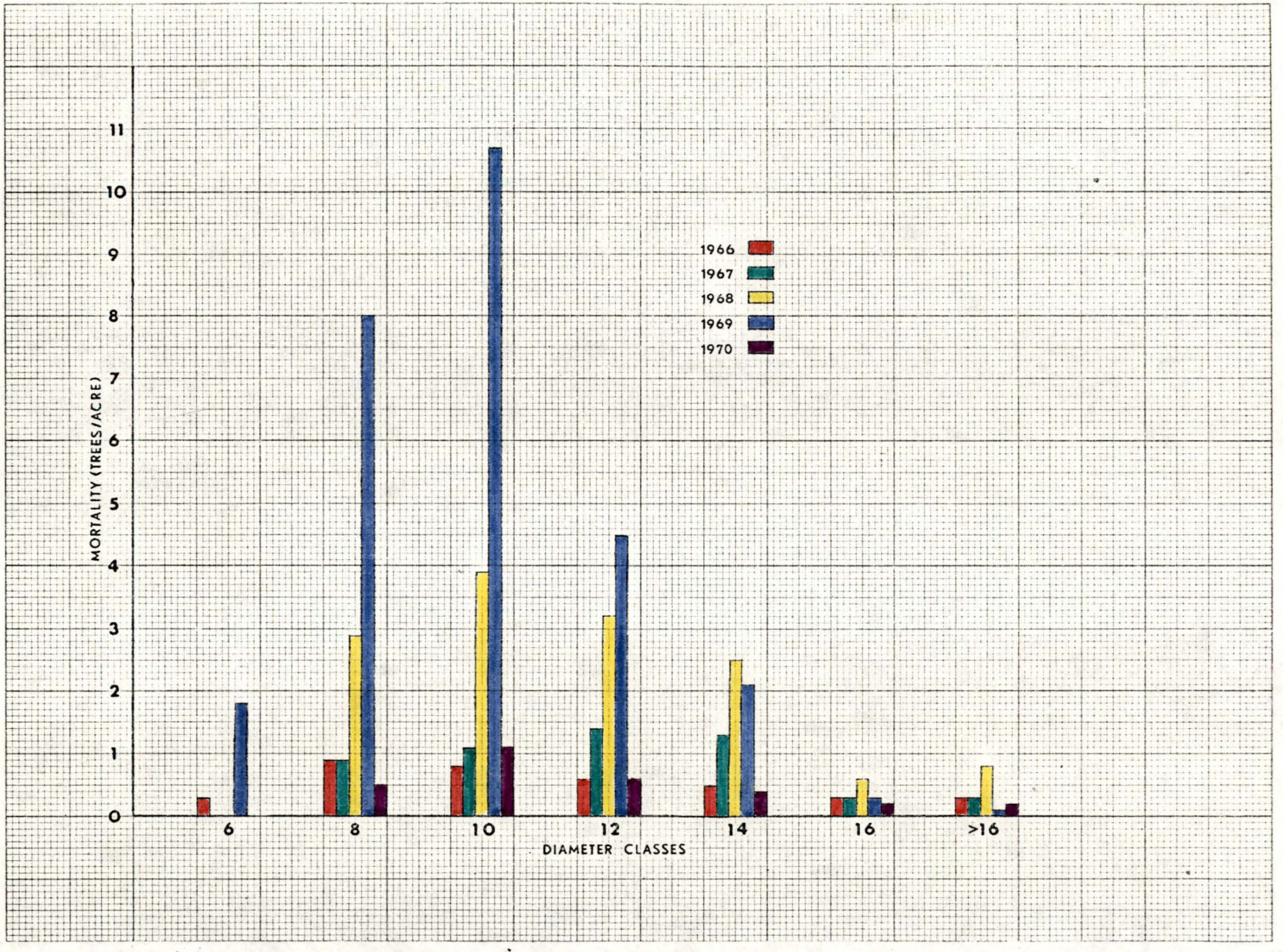

Figure 4. Mountain pine beetle caused mortality of logdepole pine by diameter class, trees per acre, and year in the southwestern corner of Yellowstone National Park.